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Space above not to be filled in by the student

AE1103 Statics

5 November 2010 09.00h - 12.00h

Answer sheets

Last name and initials:

Student no.:

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Only hand in the answer sheets!

Other sheets will not be accepted

Write your name and study number on every page

Sheets without name or study number will not be accepted.

Write relevant calculations on the answer sheet

Use the blank sides of the answer sheets if necessary.

Answers without calculations or motivation will not be taken into account.

Use possible checks to avoid calculation errors

The order of answering the questions is free

NOTE: this exam consists of 5 problems.

The **neatness of the presentation** of the answers will be considered in the marking.

All answers must be given mentioning the correct SI units.

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Name:

(problem 1 continued)

- b) Identify the zero-force members in the structure.
Identificeer de nulstaven in deze constructie.

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- c) Calculate the normal forces in members ED, CD FH, EG, FD and HK using a method of your choice with the correct sign for tension (+) or compression (-) and include these in the table on the next page. All results must be supported by calculations.

Bereken met een methode naar keuze de normaalkrachten in de staven ED, CD, FH, EG, FD en HK met het juiste teken voor trek (+) en druk (-) en vermeld ze in de tabel op de volgende pagina. Alle resultaten moeten met berekeningen worden onderbouwd.

[illegible]

Student no:

Name:

(problem 1 continued)

N_{ED}	N_{CD}	N_{FH}	N_{EG}	N_{FD}	N_{HK}

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Name:

(Problem 2 continued)

- b) Calculate the principal moment of inertia about the y-axis through the centroid in C.

Bereken het centrale hoofdtraagheidsmoment om de y -as door het zwaartepunt in C.

[illegible]

- c) Calculate the principal moment of inertia about the x-axis through the centroid in C.

Bereken het centrale hoofdtraagheidsmoment om de x-as door het zwaartepunt in C.

[illegible]

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5 November 2010

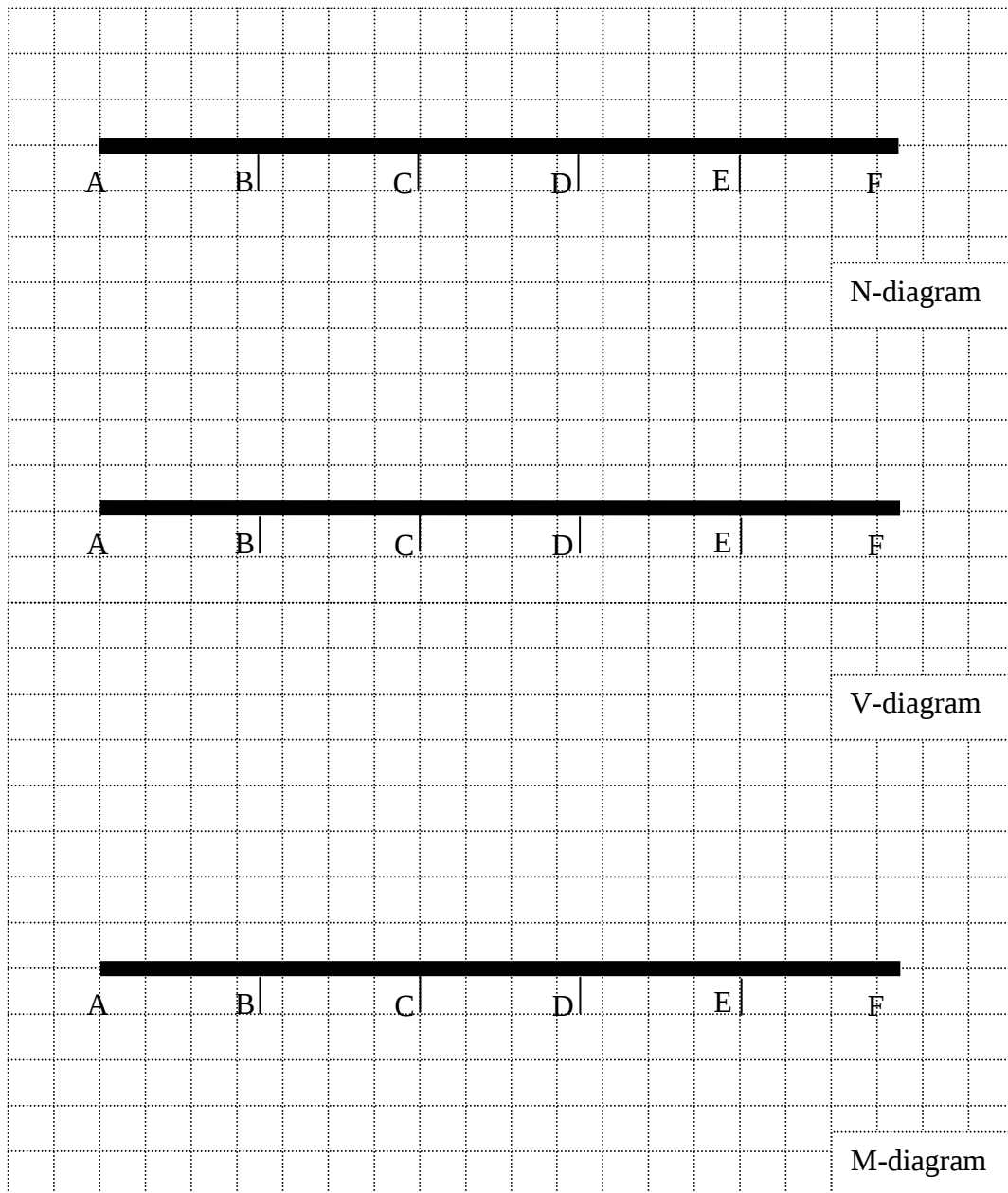
Exam AE103 Statics

Name: _____

(Problem 3 continued)

- b) Draw the normal force, shear force and moment diagrams (N-, V- and M-diagram) of the beam and use the correct deformation signs. Mention all relevant values including all (local) extremes.

Teken de normaalkrachten-, dwarskrachten- en momentenlijnen (N-, V- en M-lijnen) voor de ligger en vermeld daarbij de juiste vervormingstekens. Vermeld alle relevante waardes inclusief alle (locale) extreme waardes.



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Name:

(Problem 4 continued)

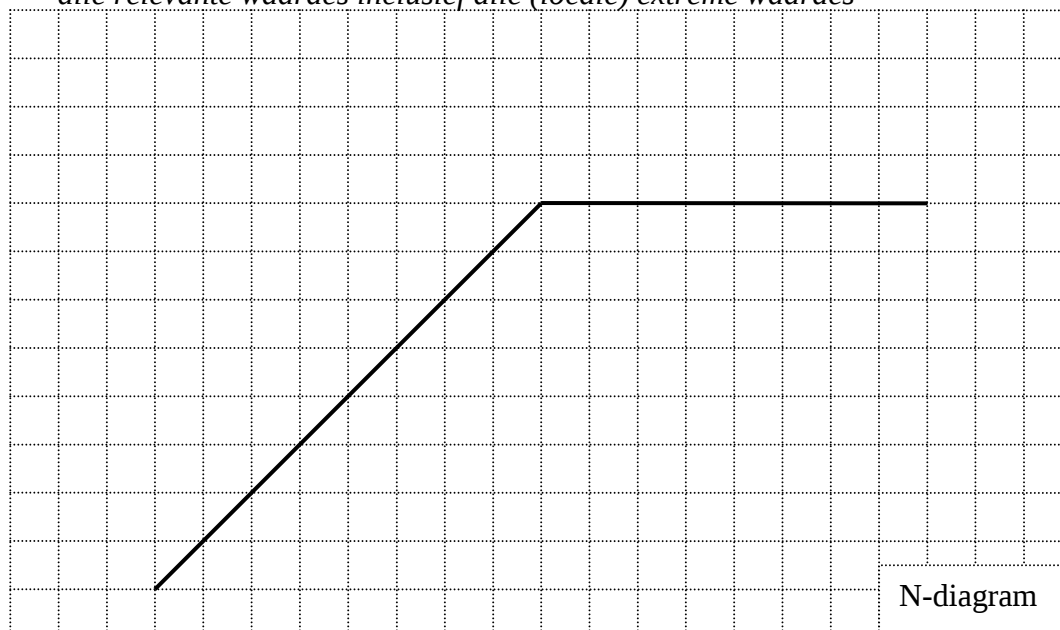
- b) Calculate the reactions in A and D and draw these in the figure in the direction in which they act on the structure in reality.

Bepaal de oplegreacties in A en in D en teken deze in de figuur zoals ze in werkelijkheid op de constructie werken.

[illegible]

- c) Draw the normal force, shear force and moment diagrams (N-, V- and M-diagram) of the frame and use the correct deformation signs. Mention all relevant values including all (local) extremes.

Teken de normaalkrachten-, dwarskrachten- en momentenlijnen (N-, V- en M-lijnen) voor de ligger en vermeld daarbij de juiste vervormingstekens. Vermeld alle relevante waardes inclusief alle (locale) extreme waardes

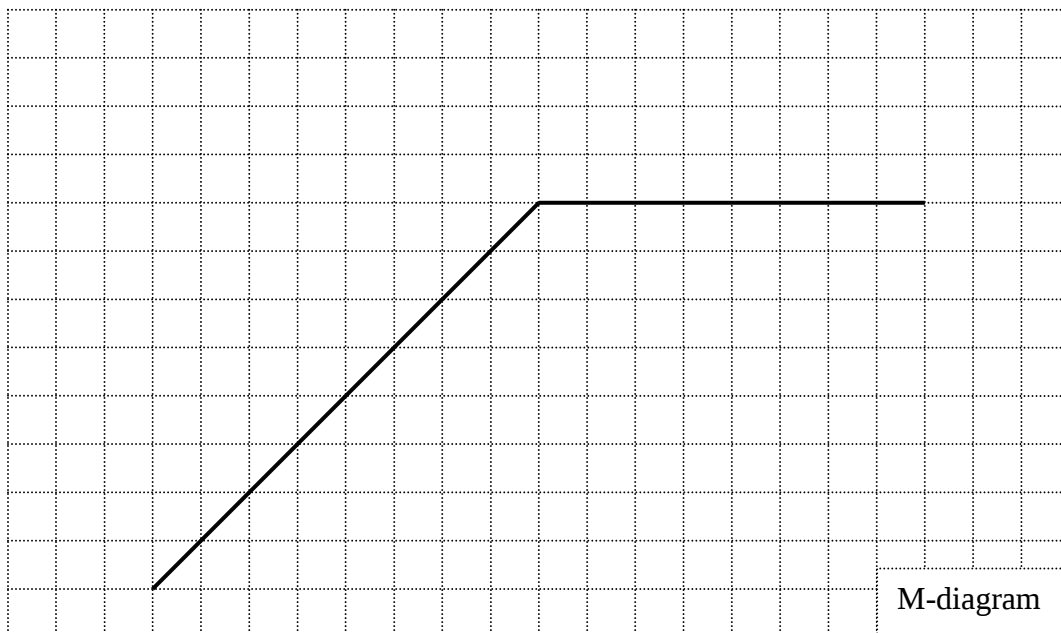
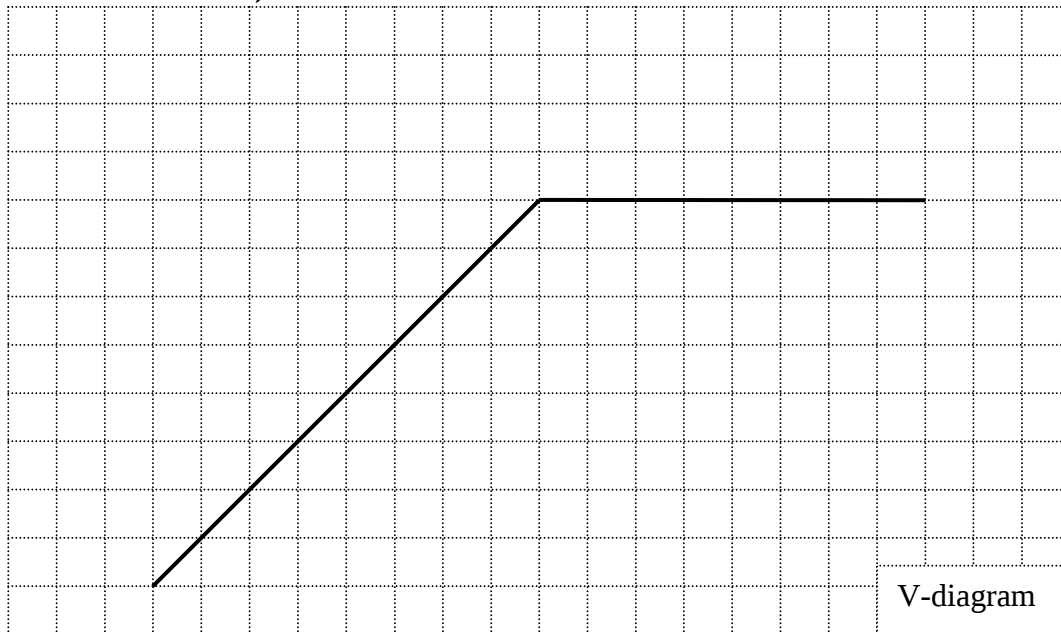


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Name:

(Problem 4 continued)



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5 November 2010

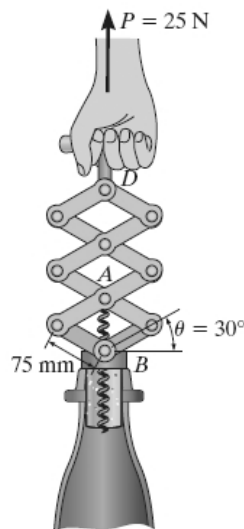
Exam AE103 Statics

Name:

Problem 5 (Weight 1.5 - approx. 30 minutes)

A corkscrew mechanism is used to uncork the bottle in the picture below. A force of $P = 25 \text{ N}$ is applied to the handle of the mechanism. The screw is attached to the pin at A and passes through the collar that is attached to the bottle neck at B.

Een kurkentrekker wordt gebruikt om een fles ontkurken zoals te zien is in het onderstaande plaatje. Een kracht van $P = 25 \text{ N}$ wordt uitgeoefend op greep van het mechanisme. De schroef is bevestigd aan de pin in A en gaat door de ring die in B aan de flessenhals is bevestigd.



Questions:

- a) Calculate the force the screw exerts on the cork of the bottle, using the principal of virtual work.

Bereken de kracht die de schroef uitoefent op de kurk van de fles, gebruik makend van het principe van virtuele arbeid.

[illegible]

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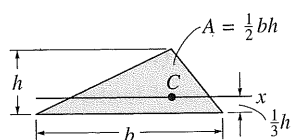
Name:

Formula Sheet Moments of Inertia – AE1103 Statics

Only this sheet may be used at the exam!

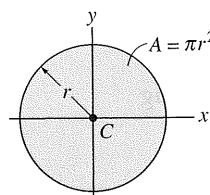
Area Moments of Inertia

Triangle:



$$I_x = \frac{1}{36}bh^3$$

Circle:

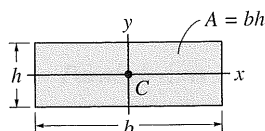


$$I_x = \frac{1}{4}\pi r^4$$

$$I_y = \frac{1}{4}\pi r^4$$

$$J_C = \pi R^4/2$$

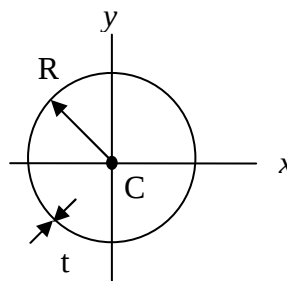
Rectangle:



$$I_x = \frac{1}{12}bh^3$$

$$I_y = \frac{1}{12}hb^3$$

Thin-walled ring

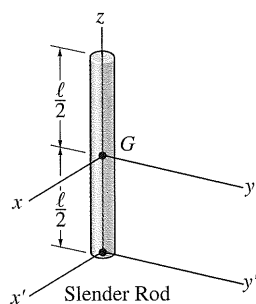


$$I_x = \pi R^3 t;$$

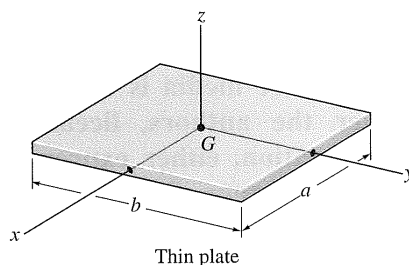
$$I_y = \pi R^3 t;$$

$$J_C = 2\pi R^3 t$$

Mass Moments of Inertia

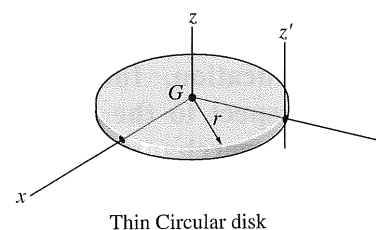


$$I_{xx} = I_{yy} = \frac{1}{12}ml^2$$



$$I_{xx} = \frac{1}{12}mb^2; I_{yy} = \frac{1}{12}ma^2$$

$$I_{zz} = \frac{1}{12}m(a^2 + b^2)$$



$$I_{xx} = I_{yy} = \frac{1}{4}mr^2; I_{zz} = \frac{1}{2}mr^2$$